

WHAT IS CLAIMED IS:

1. A process for preparing a multilayered coated article comprising:

- 5 (a) providing a substrate (S);
 (b) forming a scratch-resistant layer (R) having a surface, by applying a scratch-resistant coating composition onto said substrate, and partially curing the applied scratch-resistant coating composition, said scratch-resistant coating
10 composition comprising a polycondensate prepared from at least one silane, said polycondensate being prepared by a sol-gel process;
 (c) treating the surface of the scratch-resistant layer (R) by at least one of flame treatment, corona treatment and plasma
15 treatment, thereby forming a surface-treated scratch-resistant layer; and
 (d) forming a topcoat layer by applying a topcoat coating composition onto the surface-treated scratch-resistant layer, and curing the applied topcoat coating composition, said
20 topcoat coating composition comprising a solvent and at least one silane,

wherein said scratch-resistant layer is interposed between said substrate and said topcoat layer.

25 2. The process of Claim 1 wherein the polycondensate of the scratch-resistant coating composition is prepared from methylsilane.

30 3. The process of Claim 1 wherein the polycondensate of the scratch-resistant coating composition is prepared from a composition comprising 10 to 70 wt.% silica sol, and 30 to 90 wt.% of a partially condensed organoalkoxysilane, in a solvent mixture comprising an aqueous solvent and an organic solvent.

4. The process of Claim 1 wherein the polycondensate of the scratch-resistant coating composition is prepared from a composition comprising a silane having an epoxy group on at least one non-hydrolysable substituent, and optionally in the presence of at least one of particles and a curing catalyst selected from at least one of Lewis bases, alcohohates of titanium, alcohohates zirconium and alcohohates aluminium.

5. The process of Claim 1 wherein the polycondensate of the scratch-resistant coating composition is prepared from at least one silyl acrylate

6. The process of Claim 1 wherein the scratch-resistant coating composition further comprises methacryloxypropyltrimethoxysilane and Al(OH) nanoparticles.

15 7. The process of Claim 1 wherein the polycondensate of the scratch-resistant coating composition is prepared from at least one multifunctional cyclic organosiloxane.

20 8. The process of Claim 1 wherein the surface treatment step is performed after complete curing of the scratch-resistant layer.

9. The process of Claim 1 wherein the surface treatment step is conducted in one of a flame plant, a corona plant and a plasma plant.

25 10. The process of Claim 1 wherein the surface-treated scratch-resistant layer and the topcoat layer have an adhesion energy of > 70 mJ/m².

30 11. The process of Claim 1 wherein the surface treatment step is performed in a continuous flame treatment plant at a throughput rate of 1 to 20 m/min.

12. The process of Claim 1 wherein the surface treatment step is performed in a continuous corona plant under conditions of at least one of a throughput rate of 1 to 20 m/min, and a power of 500 to 4000 W.

5 13. The process of Claim 1 wherein the surface treatment step is performed in a plasma chamber under a pressure of 1 to 10^{-2} mbar, and at a power of 200 to 4000 W, in the presence of a process gas.

10 14. The process of Claim 1 wherein the substrate comprises a plastic.

15 15. The process of Claim 1 wherein the scratch-resistant layer has a thickness of 0.5 to 30 μm .

16. The process of Claim 1 wherein the topcoat layer has a thickness of 0.1 to 3.0 μm .

17. The process of Claim 1 further comprising:
forming a primer layer by applying a primer coating
composition to said substrate; and
forming said scratch-resistant layer by applying said scratch-resistant coating composition to said primer layer,
wherein said primer layer is interposed between said substrate and said scratch-resistant layer, and said scratch-resistant layer is interposed
between said primer layer and said topcoat layer.

18. The process of Claim 1 further comprising,
drying the scratch-resistant coating layer prior to partial curing, at a temperature of at least 20°C, by exposing the scratch-resistant coating layer to at least one of convection and radiation.

19. The process of Claim 1 wherein the scratch-resistant coating composition comprises at least one flow control agent, which is present in an amount of 0.03 to 1.0 wt.%.

5 20. The process of Claim 1 wherein the topcoat coating composition comprises a polycondensate that is prepared from at least one silane, and optionally nanoscale inorganic solid particles which have polycondensable surface groups.

10 21. The process of Claim 1 wherein the topcoat layer, after curing, has a haze of less than 10% after 1000 cycles of Taber abrasion testing.

15 22. The process of Claim 1 wherein the topcoat coating composition comprises a solvent selected from at least one of water and alcohol.

23. The process of Claim 1 wherein the topcoat coating composition is prepared by hydrolyzing,

20 (a) at least one compound represented by general formula I,



wherein M is an element selected from the group consisting of Si, Ti, Zr, Sn, Ce, Al, B, VO, In and Zn, R' represents a hydrolysable radical, and m is an integer from 2 to 4; and

25 (b) optionally at least one compound represented by general formula II,



wherein the radicals R' and R are the same or different, R' is as defined above, R represents a group selected from an alkyl group, an alkenyl group, an aryl group, a hydrocarbon group with at least one halogen group, an epoxide group, a glycidyloxy group, an amino group, a mercapto group, a

methacryloxy group and a cyano group, and a and b independently of one another have a value from 1 to 3, provided that the sum of a and b is four,
wherein the hydrolysis occurs in the presence of at least 0.6 moles of
5 water for every mole of hydrolysable radical R'.

24. The process of Claim 23 wherein the compound of formula II is present in an amount of less than 0.7 moles, relative to 1 mole of the compound of formula I.

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25. The process of Claim 23 wherein the compound of formula I is selected from at least one tetraalkoxysilane.

26. The process of Claim 23 wherein the compound of formula II is selected from at least one of glycidyloxypropyl trialkoxysilane, methyl trialkoxysilane and methacryloxypropyl trialkoxysilane.
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27. The process of Claim 23 wherein said topcoat coating composition has a solids content of 0.2 to 10 wt.%.

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28. The process of Claim 23 wherein said topcoat coating composition further comprises at least one flow control agent which is present in an amount of 0.1 to 50 wt.%, based on total solids of the topcoat coating composition.

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29. The process of Claim 23 wherein the topcoat coating composition has a viscosity of 1 to 200 mPas.

30. The process of Claim 23 wherein the topcoat coating composition is applied at a relative humidity of 50 to 75 %.

31. The multilayered coated article prepared by the process of
Claim 1.